Surgical Scar Reduction with Pulsed Dye Laser and Fractional CO₂ Laser: Combined Vbeam and CO₂RE Treatment

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Background
Scars can be a permanent disfiguring sequelae of surgery or acne vulgaris. Treatment modalities for scar reduction have progressed over the last 20 years from nonablative to ablative and eventually to fractional lasers that are effective for a range of scar types. Lasers based on fractional photothermolysis are used to minimize downtime and side effects associated with conventional non-fractional treatments, while maintaining similar clinical results. Fractional resurfacing creates areas of microscopically ablated and thermally affected columns, which are spatially separated by non-injured tissue. Moreover, fractional lasers can ablate deeper into the reticular dermis to induce neocollagenesis and a wound-healing effect, thereby providing a novel strategy for the treatment of postoperative and acne scars, in addition to wrinkles. Ablative fractional laser therapy has also been shown to provide rapid wound healing with improvement in scar pliability, texture, durability, and range of motion.

In one study, ablative CO₂ fractional laser treatment for acne scarring in Asian skin was reported to be safe and effective, resulting in normal re-epithelialization. The pulsed dye laser (PDL) has widely accepted clinical efficacy to decrease scar erythema and thickness and improve the cosmetic appearance of keloids and hypertrophic scars. One study demonstrated that both PDL and ablative fractional treatment provided significant improvement for surgical scars. However, the type of improvement seen was different for PDL compared to the fractional laser. The PDL was more effective in treating the color of the scar, while the ablative fractional treatment showed marked improvement in the contour of the scar. Recent scars are often still red in appearance and sometimes thick, and they seem to be easier to minimize compared to mature scars. Although both lasers are used as a non-surgical alternative to improve scars, combining the vascular effects of a 595nm PDL with the dermal remodeling effects of a fractional 10,600nm CO₂ laser may be used to provide a combined treatment effect with an accelerated outcome for recent surgical scars.
Methods
Described below are two cases of surgical facial scars, treated as part of a 25-patient study (15 males and 10 females; mean age 61±10 years) with observed recent post-skin cancer surgical scars on various body areas. The study consisted of 4 study arms (Arm 1 - PDL treatment; Arm 2 - CO\textsubscript{2} treatment; Arm 3 - combined treatment and Arm 4 - CO\textsubscript{2} on day of surgery, followed by combined treatment).

Patients in each of the study arms underwent 3-4 treatments, while Arm 4 underwent an additional treatment with CO\textsubscript{2} immediately after surgery. PDL was performed with the Vbeam Perfecta (Syneron Candela, Wayland, MA) with a 595 nm wavelength. The Vbeam Perfecta also has variable pulse widths, delivering energies in a single pulse or in eight sub-pulses to help alleviate purpura. Fractional ablative treatment was performed with the CO\textsubscript{2}RE system (Syneron Candela, Wayland, MA) – a second-generation fractional CO\textsubscript{2} laser. A unique feature of the CO\textsubscript{2}RE system is the availability of different treatment modes and pattern shapes to simultaneously penetrate to both the epidermal and the dermal layers. The CO\textsubscript{2}RE system offers six ablative modes - four modes for fractional skin resurfacing and treatment of lines and wrinkles (Light Mode, Mid Mode, Deep Mode, and Fusion Mode), one mode for fully ablative resurfacing (Classic Mode, useful for actinic cheilitis) and one mode for incisions (Surgical Mode). The laser beam is delivered to the target tissue, after being scanned by a double-axis scanner into a pattern of pre-determined shape, size, and depth and selected energy.

Case Study 1: PDL Treatment with Vbeam
A 55-year old female with Skin Type I presented with a postoperative scar above the right eyebrow at Day 9 following Mohs surgery. The patient underwent 4 PDL treatments at an average of 7.5 week intervals with the following parameters: spot size 10mm, fluence 7.5J/cm\textsuperscript{2} with pulse duration 1.5-3.0 milliseconds. Clinical outcome was assessed at 1 and 3 months following treatment. Scar tissue was significantly improved from a score of 8 at baseline to 0 at 1-month follow-up after treatment, as assessed using the Vancouver Scar Scale (VSS) (range 0-9). Global Evaluation of Response (GER) was 4-“almost cleared”, based on 7-point scale (-1=worsening; 0=no change; 5=completely resolved). The patient was extremely satisfied with treatment.

![Before tx 1 Before tx 2 Before tx 3 Before tx 4 1 month after tx 4 3 months after tx 4](Images.jpg)

Photos: Joel L. Cohen, MD (Englewood, Colorado, USA)
Case Study 2: Combined PDL (Vbeam) and Fractional CO$_2$ Treatment (CO$_2$RE)

A 57-year old male with Skin Type II presented with a postoperative scar above the left eyebrow at Day 10 following Mohs surgery. The patient was randomly assigned to undergo 3 combined treatments at an average of 7 week intervals with the following parameters: PDL with spot size 10mm, fluence 7.5J/cm$^2$ with pulse duration 1.5-3.0 milliseconds and CO$_2$ with spot size 8.4x8.4mm and 25% Fusion Mode for the first treatment and spot size 7.8x7.8mm with 30% Fractional Mode for the second and third treatments. Scar tissue was significantly improved after 3 treatments, from a VSS score of 8 at baseline to 1 and a GER score of 5—completely resolved already at 1-month following the treatments. The patient was extremely satisfied with treatment.

Conclusion

The study demonstrated a very favorable safety profile and clinical efficacy of the various treatment options, using the Vbeam and CO$_2$RE device for surgical scar reduction. There was improvement in 100% of the scars treated by PDL and also with the combined PDL and ablative fractional CO$_2$ treatment approach, while 83% of the scars treated with just fractional CO$_2$ experienced improvement, regardless of the time of treatment. Mild to moderate temporary erythema was observed after treatment, and there were no reports of pigmentation changes or lasting adverse effects. Although standalone PDL and standalone fractional CO$_2$ laser can each significantly improve recent surgical scar appearance, the combined approach has the potential of treating different aspects of recent scars. For example, in Case Study 2 described here, the scar was completely resolved after 3 combined Vbeam/ CO$_2$RE treatments compared to almost resolved after 4 treatments with Vbeam alone (Case Study 1). Furthermore, as supported in this study and in the literature, early treatment of scars can improve overall results.$^{9-11}$ The various treatment modes and scanning patterns available with the CO$_2$RE system, as well as the ideal PDL wavelength and variable pulse widths available with the Vbeam, both enable physicians to customize treatment for optimal clinical safety and efficacy for their patients.
References